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ABSTRACT

This document discusses the nature and cause of problems associated with insect pests in stored grain. Particular attention is given to large and small beetles and stored grain moths. (CS)

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Pests of Stored Grains

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PESTS OF STORED GRAIN

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PESTS OF STORED GRAIN

Numerous insects and a few mites may become pests of stored grain, whether it is being held in small lots in the household, in large quantities on the farm, or in bulk in elevators and mills. The nature, cause, and treatment of stored grain problems on the farm and in elevators are different from those encountered in the household. The latter are covered in the preceding division.

A. Basic Causes of Problems

Low winter temperatures and hot dry summers in this area usually keep insect infestations from developing in the various stored grains or grain crops. Some of the attacking species live only in the warmer, more humid parts of the country and are unable to survive here. Others, however, have adapted to colder northern climates and may attack and destroy any grain containing sufficient moisture. The low relative humidity of this area normally keeps the mature grain too dry for insect attack. An abnormally wet harvest season or other unusual circumstances, however, may leave enough moisture in the grain to make it susceptible.

Locally heavy infestations may develop where the grain is sufficiently moist, provided there is a source of the pests. The grain also reacts with the moisture and produces heat, which in turn allows survival of stored grain pests in spite of low winter temperatures. Problems with stored grain pests thus can nearly always be traced back to a source of moisture, whether it be in the grain itself or from an outside supply, such as a leaking roof, poor surface drainage, or underground seepage.

B. Pests Involved

1. Large Beetles

a. Mealworms

The mealworms are larvae of black, elongate-oval beetles about 3/4 inch long. Two species occur: the yellow mealworm larva is golden yellow and the adult beetle is polished (shining) brown to black; the dark mealworm larva is dark brown and the adult beetle is dull black (not shining). The larvae of both are long (1 - 1-1/2 inches), slender, tapered to the posterior, clearly segmented, and have a characteristic "hard shelled" texture of body. They have a slight side-to-side worm-like movement when crawling.

Winter is passed in the late larval stage. Pupation (in unheated sites) occurs in the spring and adults emerge in late spring or early summer. Eggs are minute, white, and deposited singly within the food material. Each egg is covered with a sticky substance when deposited and soon has a coating of foodstuff particles. Dark mealworm larvae reach full size in about 3 months, but the yellow mealworm larva may require 9 months to grow to adults, and, in highly unfavorable conditions, may go through two full seasons to reach full development. Infestations developing indoors (heated locations) may produce yellow mealworm adults in November or December. Dark mealworm adults may begin to appear in late January. The adults live 2-3 months, and the females produce 250-300 eggs each (yellow) or 450-500 (dark).

Mealworms are essentially a problem of spilled or spoiling grain and grain products, which attract the beetles as scavengers. They live in accumulations of grain in out-of-the-way locations in mills and elevators; around and under sacks of feeds and grains in warehouses and feed stores; in damp grain or grain products in or under bins, storage sheds, or in various farm and home locations, such as chicken house litter, bird cages, and various aging grain products. Fully developed larvae leave the feeding site and wander all over, probably seeking a place for pupation. The presence of hordes of crawling larvae frequently causes more concern than does their feeding damage. The larvae may crawl into almost any type of container and cause the contents to be classed as contaminated even though they are not feeding therein.

b. Cadelle

The cadelle beetle is a common pest of farm stored grain and also occurs widely in elevators and mills. The adult is black, about 1/3 inch long, flattened, has a neck-like constriction between the back of the prothorax and the base of the wings, and has several longitudinal grooves on each wing cover. The last five antennal segments are enlarged. Larvae grow to about 3/4 inch long, are fleshy white, and have a black head and two black curved spines on the posterior end.

Adults may live 2 years. Females, meanwhile, may produce 1,000 or more eggs each. Eggs hatch in 1-2 weeks and total egg-adult development takes 2 months or more, depending upon conditions.

Larvae feed upon grain and various grain products, and burrow into the wood parts of bins, boxcars, mills, and elevators and spend much of their time in these hiding places. These also furnish an excellent hiding place for many smaller insect pests of grain. Thus, bins which appear free of insects may be harboring thousands of live pests in the cadelle burrows, and within a few days after harvest the new grain is swarming with various beetles and larvae.

2. Small to Minute Beetles

a. "Weevil"

This problem is due primarily to the granary weevil in the northern states, and in the warmer, more southern areas the rice weevil is of equal or even more importance. The weevil adults are about 1/8 inch long, are reddish brown to black, and the head is prolonged outward and down ("snout beetles"). Chewing mouthparts are located on the apex of the snout.

The rice weevil can fly, and has four light colored spots on the back. The thorax is lightly covered with punctures and wing covers have rows of small punctures.

The granary weevil cannot fly, and is solid colored. The thorax has numerous deep punctures, and the wing covers have logitudinal grooves.

Rice weevil females can fly to the fields and start an infestation by laying eggs in the maturing kernels. In the northern part of its range, however, it remains in or around storage facilities, infesting and reinfesting stored, spilled, or waste grain.

The granary weevil, unable to fly, can start new infestations only by crawling or by being carried to new supplies of food grain.

Female weevils chew small holes in kernels of grain then deposit an egg in each hole. The egg is held in place by a "plug" of gelatinous material secreted by the female after each egg is placed. Each female may produce up to 400 eggs. Egg to adult takes about 1 month or more, depending upon temperature. The larva is very small, whitish, grub-like, and hollows out the interior of the seed as it feeds and grows. These insects are also able to breed in solidified flour products such as macaroni.

b. Grain Borers

Although these beetles apparently do not now occur in this area, there is a good possibility that one of them, the lesser grain borer, may become a pest in the future. This beetle is about 1/8 inch long, shining dark brown to black, and has a rounded, bulbous thorax with a small head attached underneath. The head thus is visible from the side but not from above. Minute put powerful jaws chew into whole grain, wood, sacking, and other materials.

Female beetles produce 300-500 eggs each. The eggs are dropped loose in the grain, where tiny white grub-like larvae hatch and

crawl about, feeding on the bits and pieces dropped by the adults, or boring directly into kernels that have already been damaged. Development may be completed within a grain or in accumulations of debris. The egg to adult period is about 1 month.

Both adults and larvae cause severe loss in stored grains and also breed in flour in storage. The adults have strong powers of flight and spread rapidly from infestation sites.

c. "Bran Bugs"

This category includes a number of small beetles which do not directly attack whole stored grain. They feed upon damaged grain, bits and particles dropped by other feeding insects, and in a wide variety of accumulated brans, flours, cereal products, and pet foods in mills, elevators, granaries, and the home. Some 15-20 species are included here; the two most common types (confused flour beetle, saw-toothed grain beetle) have been discussed in detail in the chapter on Household and Structural Pests. The other species are similar in size and habits to one of the others above.

Adults of various forms may live a year or longer. Females may produce 500 or more eggs each. Development (egg to adult) may be completed in 2 weeks in some species but may require 9 weeks or more in others. Infestations thus build up rapidly when the temperature and the food supply are adequate.

Adults and larvae of these beetles spread over every part of mills, elevators, granaries, and homes; wherever an accumulation of grain dust, grain fragments, or grain products are found. They find their way into milling machinery and from there into packaged products. These insects probably are the most widespread and persistent stored grain problem in the entire country, and many have world-wide distribution.

d. Spider Beetles

These long-legged little flightless beetles have a small head and thorax and a larger, rounded or globular body, which causes them to superficially resemble small spiders. Several species have a hairy covering over the body but others are hairless and shining brown. One species (Ptinus fur) is of considerable economic importance to stored grain in bins, elevators, and warehouses.

Development is relatively slow, with only one generation per year. Eggs are laid loose in the foodstuff. Larvae are very small, grub-like, and frequently live and feed within small

globular cases. Infestations build up slowly except in protected areas with good food supply.

Spider beetles may attack stored grain, but usually they are scavengers. Thus they may be found in warehouses, heated basements where trash and food scraps accumulate, and occasionally in granaries and elevators. Some species apparently are associated with rats, possibly utilizing the rats' droppings as a food source.

e. Dermestid Beetles

These small, oval, usually dark and scaly beetles also have been discussed in detail in the Household Insects chapter. Adults and the hairy larvae are both injurious to grains and grain products on occasion. The khapra beetle is a recently imported dermestid pest which attacks grain in elevators, mills, or warehouses. Infestations increase with extreme rapidity, so that the entire premesis is soon infested. Cast larval skins and bodies of larvae and adults sometimes build up into layers several inches deep inside or around an infested building.

Occasional, usually minor problems with native dermestids will be encountered in this area. The khapra beetle is not now known to occur here but is a potential future invader.

3. Stored Grain Moths

These insects cause severe problems in stored grain by (1) direct damage by the larvae to the grain, and (2) extensive webbing of the surface of grain, and in or about machinery in elevators and mills. The adult moths do not feed but fly actively about in the infested structure, placing eggs in every suitable location.

a. Angoumois Grain Moth

This insect is not established in this area at the present time but may be a possible future threat. Adult females fly to developing grain in the field, and lay eggs on the milk-stage kernels. The moth is very small (1/2 inch long), light tan, has narrow wings fringed with long "hair," and has long, slender antennae.

Development in field grain is rapid (egg to adult, 5 weeks) and infestations build up rapidly. Once the grain is harvested and in storage, the moths are unable to penetrate below the surface, hence "inside" infestations are limited to the surface layer of grain. Each female produces about 40 eggs (some almost 400) and these hatch into minute white larvae. The larvae bore into individual kernels and complete the entire life cycle inside the

one grain of wheat or corn. Before changing to the pupal stage, the larva chews a small circle inside the kernel to serve as an escape hatch for the new adult moth.

Field infested grain will supply new adults for reinfestation of surface layers of grain in storage. Before or between crops, the insect continues to breed in other grain in barns, granaries, corn cribs, and waste grain in the field or around straw stacks.

b. Indian Meal Moth

The larva of this insect is a common and very severe pest of stored grain and grain products. It feeds and develops extensively on ear corn, but also infests shelled corn and virtually every other type of stored grain. The larvae can also work their way through sacking material and thereby gain access to the product for infestation within the bag. It also feeds freely on dry cereal products (c.f. Household Insect chapter).

The adult has banded wings (light in the middle, dark at the end), and long, slender antennae. Each female produces about 200 eggs, and new larvae are dirty white, pinkish, or light greenish. Full size larvae are about 1/2 inch long. The larvae spin silk over everything in their habitat. Egg to adult requires about 4 weeks in summer.

c. Mediterranean Flour Moth

The flour moths are primarily pests of mills but will develop in grain products accumulated in other locations. Three other closely related species cause trouble in other parts of the country and may eventually become established here.

The adult insect has grayish front wings with wavy black lines. The hind wings are dirty white and each has a narrow border of hair-like scales. Full grown larvae are about 1/2 inch long and are white to pinkish. Egg to adult development requires 8 or 9 weeks under normal summer conditions.

Larvae spin silk as they move about and problems develop as the webbing starts clogging the elevator or machinery. Extensive webbing is also found in various other sites of infestation, such as granaries, corn cribs, and elevators. The immature stages may be packaged with the grain product and eventually wind up starting new infestations at the destination of the package.

4. Miscellaneous

a. Grain Mites

These are minute crawling animals which may build tremendous populations in damp, moldy grain or grain products. They feed on a wide variety of plant and animal matter, so that an infestation in grain may have started from an entirely different source. They do not bite people but are a nuisance to persons handling infested grain, although they do not cause serious damage to grain under normal storage conditions.

Females produce viable eggs without males, and each female may lay 100 or more eggs. The young are similar to the adults (8 legs, long filamentous hairs on legs and body) and grow rapidly. The egg to adult period is about 3 weeks in summer.

b. Psocids

The psocids or booklice are minute white insects which may build up large populations in damaged, damp, or moldy grain. They feed on starchy materials in the habitat and will spread over wide areas. They also are packaged with the finished product and thereby find their way into homes and restaurants. If left along in an opened but partially unused package, they eventually build up such populations that they spill over and spread over extensive areas.

All stages are wingless, and eggs are produced and dropped in the food material. Development is rapid in warm habitats. Both adults and young have a narrow "neck" in the thoracic region (behind the head), followed by a wider body. The antennae are long and slender.

c. Parasites and Predators

A considerable number of wasps, flies, mites, and other forms may be found in long-established stored grain infestations. These may attack the eggs, larvae, pupae, and occasionally the adults of the pest insect. In general, they may be considered helpful but not adequate to effect immediate or complete control of the stored grain pest.